ELECTROLYTIC MATRICES

Nuernberger

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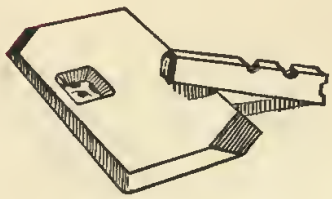
Phil T. Nuernberger



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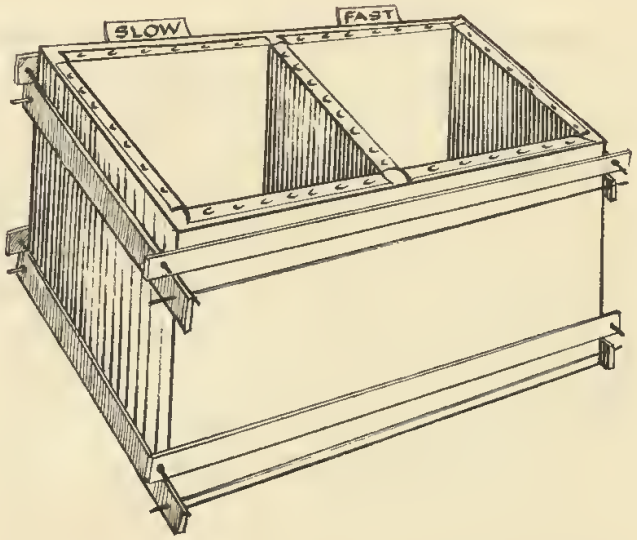
Introduction

The essay which follows was originally in the form of a personal communication between the late Mr. Archie J. Little, Letterfounder, of Seattle, Washington, and Mr. Phil T. Nuernberger, of Chicago, Illinois. The communication was dated May 18, 1931.

Mr. Nuernberger will be long remembered for his contributions to the field of typefounding and typecasting machine development, and specifically for his development of the Nuernberger-Rettig typecasting machine. As with all such machines during the early days of their development, one of the most critical problems was the making of matrices in the quantities

and varieties demanded by the typographers of the day. It was doubtless in this regard that Mr. Nuernberger first made his investigations in the field of electrolytic matrix-making. Certainly the principles had been understood for many years prior to this time, and, indeed, nearly every typefoundry in the world indulged in the "pirating" of type designs of its contemporaries. To quote from "A Short History of the Firm" which Harry Carter wrote as an introduction to THE HOUSE OF ENSCHEDÉ (Haarlem, 1953), "The making of matrices by electrolysis, an American invention, was taken up in 1846. No invention ever spoiled a trade more than this; typefounders used it to pirate one another's types and were afraid to originate new ones for that reason. Honest typefounders were those who owned to the practice of contrafaction..." (page LII) Leaving aside the question of ethics, the practice had nonetheless a profound influence upon the eventual course of the development of typefounding, and it is because of this influence that this monograph has been published. There are today several developments in electrochemistry which have obviated some procedures outlined below, but the manuscript has been presented here in its original form because of its historical importance, and not primarily as a document of scientific or practical instruction.



ELECTROLYTIC MATRICES

Tanks

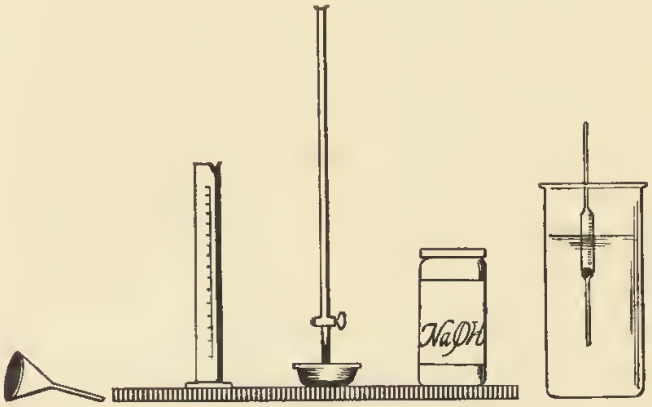
Two solution tanks are necessary, one for the "Slow Solution" and one for the "Fast Solution." Each should be about 18″ deep, 24″ wide and 36″ long; should be made of the best selected 2″ thick kiln-dried lumber, carefully jointed and securely put together with long iron bolts. They must be lined with sheet lead, 1/16″ thick, having all seams burned, not soldered, and the lining must be coated with a prepared tank lining, commonly called asphaltum, which can be obtained from electroplating supply houses. Do not use common roofers' pitch or tar as these frequently con-

tain matter that is ruinous to the solution and work. The work is first put in the "Slow Tank" where it must remain about 96 hours so the copper will at first be deposited very slowly to give it a fine even grain next to the face of the type. From the "Slow Tank" it is transferred to the "Fast Tank" until sufficient copper has been deposited to fill up the square hole in the Matrix. Thus, when the surplus copper high spots are removed from the back of the matrix, it will leave the copper surface smooth and even with the brass, and without any holes or depressions.

Solution for Battery Tanks

1—For the "Slow Tank" 1½ volts 0.3 Amp
Sulphate of Copper (Bluestone) dissolved in water until the solution registers 14 degrees on a Baume Acid Hydrometer. Then add Sulphuric Acid until the hydrometer registers 16°—enough solution to fill the tank within two or three inches from the top should be used when battery is in use. After solution is made, the sulphuric acid content should be between 2% and 3% to be ascertained by testing.

2—For the "Fast Tank" 2 volts 0.3 Amp
Make the solution the same as for the "Slow Tank" but Sulphuric Acid content must not be less than 5% nor more than 7%. Do not agitate solution while battery is in operation.



EQUIPMENT NECESSARY FOR TESTING SOLUTION

1 Hydrometer, acid Baume 0 to 70
1 Glass Hydrometer jar, 12″ x 2″
1 Glass Graduate, 16 oz.
1 Porcelain evaporating dish, ½ qt.
1 Burette Tube, 50cc capacity, with tip and connection for pinchcock
1 Burette support
1 Pipette, 20cc capacity, for removing small solution portions
1 Glass funnel, ¼ pt.
1 Glass dipper
1 lb. Sodium Hydroxide, C.P.

To test for sulphuric acid content, proceed as follows: Draw enough solution from the tank into the Hydrometer Jar so the Hydrometer will float freely therein without touching the sides or bottom of the jar and test the degree of the solution; make a note of the degrees specific gravity. With the pipette draw 10cc solution from the jar and put it in the evaporating dish. Put a small quantity of NaOH in the burette tube, read the graduations to ascertain the amount it contains and place the evaporation dish with the solution in it under the end of the burette tube so NaOH can be added, drop by drop from the burette tube to the solution in the evaporation dish.

Now add the hydrate of sodium from the burette tube by working the pinchcock so that the NaOH will drop into the solution in the evaporating dish, drop by drop, constantly stirring the solution with the glass stirring rod; as the NaOH is added the solution will at first remain clear but gradually it will show a cloudy condition and separate when the clear liquid is on top and a green liquid in the bottom of the evaporating dish; when it is in this condition, stop adding the NaOH. Now read the graduations on the burette tube and ascertain how much NaOH has been added to the solution in the evaporating dish, and then use the following table for figuring the amount of sulphuric acid in the solution:

When solution is:	Its specific gravity is:
15 degrees Baumé	1.116
16 degrees Baumé	1.125
16½ degrees Baumé	1.129
17 degrees Baumé	1.134
17½ degrees Baumé	1.138
18 degrees Baumé	1.143
18½ degrees Baumé	1.148
19 degrees Baumé	1.152
19½ degrees Baumé	1.156
20 degrees Baumé	1.161
20½ degrees Baumé	1.166
21 degrees Baumé	1.171
21½ degrees Baumé	1.176
22 degrees Baumé	1.180
22½ degrees Baumé	1.185
23 degrees Baumé	1.190
23½ degrees Baumé	1.195
24 degrees Baumé	1.199
25 degrees Baumé	1.210
26 degrees Baumé	1.221

Constant: .049

Multiply the constant by the amount of NaOH used and divide result by specific gravity.

Example:

Constant .049
NaOH amt. 10
Spec. Grav. 1.116) .04900000 (4.3
4464
4360
3348
1012

Amount of sulphuric acid in proportion to copper sulphate as ascertained by above example is 4.3.

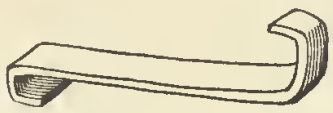
When solution is found to contain "free acid" it must be reduced. 6½% to 7% is a good acid content. Now say the solution after a test shows 10% "free acid" which is in excess; take out a gallon of solution and add one gallon of water. Try the solution again by the NaOH test and you will find that the acid content has become less, due to the fact that you have thrown away some of the solution. Keep doing this until the acid content registers correctly. Use the hydrometer to watch the degrees as you take out solution and add water. After your acid content is completed and you are ready, you will note the hydrometer will show a different reading. Then add copper sulphate until the hydrometer reads as it originally did before you threw away solution and added water.

Solution in use should be tested for sulphuric acid content once every week.

When it is necessary to add new solution to what is already in the tank in order to make it of correct proportions, remove enough of the old solution to make room for the new.

Copper Anodes

The most satisfactory kind is the electrically deposited plate termed, electrolytic anode, which should be about 1″ thick. The best results are obtained by having the total anode surface facing the cathode about equal to the cathode or work surface with a distance between anodes and cathodes of from 3½ to 6 inches. Anodes should be totally submerged and must be suspended in the solution, connected with the positive tank rods or conductors, the connection is usually made by copper hooks, but care should be taken that the hooks do not come in contact with the solution as the electrolytic action will cause the hooks to corrode, become thin and useless.



Hook for holding flasks

Note: Hooks made of a type of metal of the following formula: Tin 10%, Antimony 20%, Lead 70%, are the most desirable and economical as they will not corrode and can be used continually. Never use hooks made of lead only as pure lead will spoil the solution.

Equipment Required for Operating Battery

Dynamo (Shunt wound, self-excited 4 volts D.C. 50 and 150 amperes)
Rheostat for field regulation
Rheostat for field (main line)
Voltmeter for tanks
Tanks, 18″ x 24″ x 36″ for solution
Copper rods for tanks
Rod connections for tanks
Copper rods for main line
Connections for main line
Connecting wire or thin rod for tanks
Hooks made of lead 87%, antimony 13% for hanging flasks in solution

Articles and Materials Required for Waxing Flasks

Lamp black — Brush, flat, 1½″ wide
Venice turpentine — Beeswax
Building up iron (copper) used by electrotypers
Enameled pan (about two quarts) for melting wax
1-burner gas plate or electric
Gasoline, for cleaning
2 pails or jars for gasoline when cleaning mats
Kettle for boiling water
Dipping basket — Iron plate for drying mats

Operations

1. Blank brass
2. Stamped brass
3. Routed brass (square hole)
4. Flattened brass
5. Type
6. Type soldered in block (or to angle quad)
7. Soldered type waxed into block
8. Brass soldered to block
9. Brass, with block attached, covered with wax mixed with lamp black
10. Deposit of copper into hole made by operation 3
11. Deposit of copper rough milled close to brass
12. Deposit of copper machined off flush with brass
13. Hanger to which brass and block covered by operations 1 to 8 inclusive, is to be attached

Waxing

Melt the beeswax and add 1 tablespoon of lampblack to each quart of molten wax, stirring it well to thoroughly mix. Wax once used and removed from the work must be "toned up" by adding one tablespoonful of venice turpentine to each quart of wax that has been used.

For waxing the flasks, use a flat brush with bristles of medium stiffness. Apply the wax in layers, being very careful not to get any of it into the hole in the brass in which the character is mounted. The flask is the long strip with a hook, containing a number of ma-

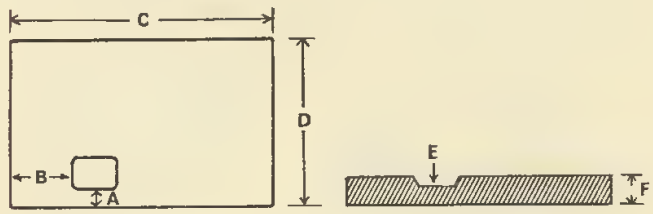
trices, which is hung into the battery for growing the copper onto the face. Before placing the flask of matrices into the battery, the face of the type as well as the side walls of the hole in the brass must be thoroughly cleaned. Any dirt or grease in the cavity would prevent the copper deposit from filling in. If a film of any kind is on the side walls of the hole in the brass it must be scraped out with a sharp instrument and afterward the hole as well as the character therein should be cleaned with pure grain (not wood) alcohol.

To remove wax from the flask of matrices after being taken from the battery, place the flask in a wire basket, submerge it in boiling water, then skim off the wax which will appear on the surface of the water. Take out the matrices and place them in gasoline, remove the grease and finally finish them in a second bath of gasoline to thoroughly cleanse them.

Size of matrix: Thompson style, .875″ wide, $1\frac{3}{16}$″ long, and 7 points thick. Depth of face .043″. Head bearing 18 points (.24912″).

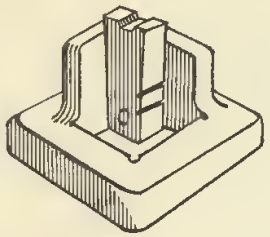
Heading bearing means distance from top of matrix to top of back of type when the type is cast and placed with the face in the matrix in which it was cast. The distance from the top (upper end) of matrix to the top or back of the type should be 18 points—not 18 points to the face, as the size of the face is not always the same in all styles of faces.

Side bearing 8 points. Side bearing is the distance from the fixed or permanent side of the matrix to the side of the type when the type cast in the matrix is placed with its face in the matrix in which it was cast.



*Thompson Matrix dimensions: **A** (side bearing) = 8 points; **B** (head bearing) = 18 points (0.2491"); **C** (length) = 1.1875"; **D** (width) = 0.875"; **E** (depth of drive) = 0.043"; **F** (thickness) = 7 points (0.0969").*

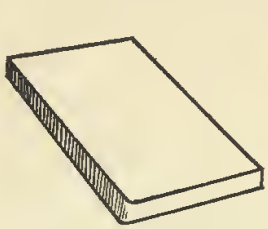
When the face of the type from which the matrix is to be made is not perfectly smooth, it is necessary to face or polish it. This is done by rubbing the face on



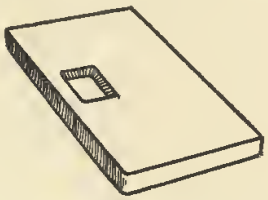
Jointer for facing-off type or punch squarely

a very fine water hone. The best hone is called "Water of Ayer," a Scotch stone. The type must be held with a jointer or some other tool so that the face of the type will be exactly square with all sides of its body.

In facing, only enough of the surface of the character must be removed to make it smooth and flat. If too much is rubbed off the lines of the character, it will be heavier than originally. In this case it is necessary



Brass matrix blank

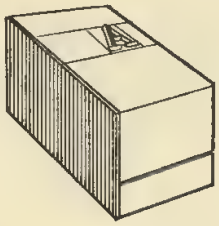


Routed matrix blank

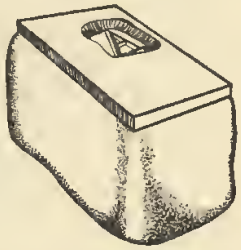
to go over the sides of the lines with an engraver to bring them back to their original thickness.

If the depth of the character from its face to the shoulder of the type is not as deep as the depth of the ma-

The type



Type blocked to matrix size

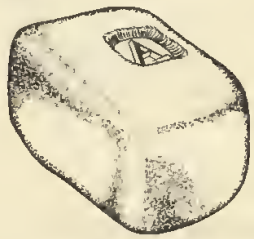


Waxed case with brass blank in position

trix you intend to make, it will be necessary to trim this shoulder down with an engraver.

The exhibits or samples we furnish showing the different operations from cutting the plain brass to the

proper length and width for the matrix, routing the square hole for the character, type mounted in a metal block ready to attach to the brass, with square hole, –6 matrices mounted on a brass bar with hanger, three of which are waxed while three are not, will show how they are mounted before waxing, but all



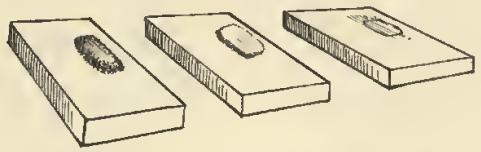
Waxed case ready for depositing

Waxed case after despositing

six must be waxed before hanging them in the tank. These samples have been made according to methods employed in one of our matrix-making plants.

If it is desired to make matrices without first mounting the type, that has been cut off, in a metal block, this may be done by placing alongside of the full length type, a quad of the proper thickness to give it the side bearing which we advise should be 8 points thick, placing at the top of the type a slug for the head bearing which we advise should be 18 points and then filling in the side opposite the side bearing with quads of sufficient set-wise dimensions to fill the entire width of the brass, and place at the bottom of the type another slug so that the entire type is surrounded by

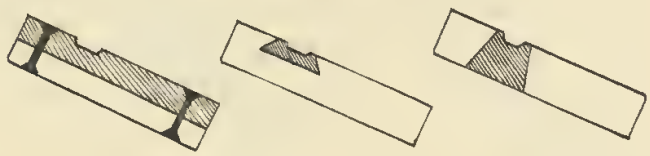
slugs and quads. Then wax over so that only the face is exposed as shown in the flask. Care must be taken of course that the type will project into the square hole in the brass just far enough that the face in the finished matrix will be of any predetermined depth. This can be done by cutting pieces of leads small



Back-milling or grinding; coarse, close, smooth

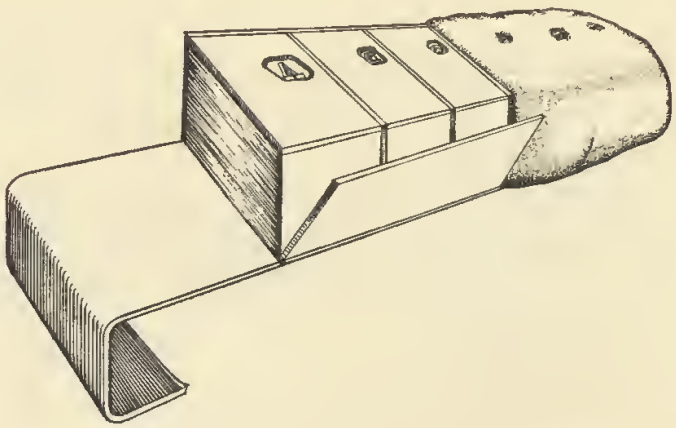
enough to lay in the hole in the brass and thick enough that when the face of the type rests thereon it will be just deep enough in the hole for the required depth of the finished matrix.

We advise that the matrices be made according to the Thompson or Monotype Flat Matrix style in prefer-



Riveted matrix *Dovetailed matrix* *Nuernberger matrix*

ence to the so-called foundry style matrix because it is cheaper; when the foundry style matrix is made of two sections, front and back plate; or if it is made with a heavy piece of brass which has been dovetailed and the copper deposit fitted into it, it entails a great deal



Flask with three waxed cases, three unwaxed

of labor that is not necessary, when copper is deposited directly into the brass as it is in this matrix.

For finishing the matrices after they come from the battery, it is necessary after the wax has been removed first, to remove the copper deposit from the back thereof. Then with a needle depth gauge test the matrix for depth; when too deep rub it off on a fine sandstone which must be perfectly flat, and to prevent it from wearing down quickly cover the stone with lubricating oil once or twice a week.

The alignment of the matrices should be made uniform. This is best accomplished by holding the matrix in a hand mold and taking a hand cast of the character. Place the hand cast type on the lining gauge and when necessary remove a little from the end of the brass matrix until the hand cast taken therefrom will align with any predetermined alignment on the gauge.

A simple metal pot with nozzle and pump in which the pump is operated by a hand lever is the most desirable for making hand casts.

For finishing or trimming the sides of the matrix as well as the ends thereof, a fitting machine, so-called, is most desirable. This is a mechanical cutter with trimming knives.

This book has been edited, designed, illustrated, printed and bound at the Private Press and Typefoundry of Paul Hayden Duensing, in an edition of 100 copies, during the summer of 1966, for the annual meeting of The Typocrafters, in Pittsburgh, Pennsylvania, October 1-2, 1966.

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Title-page ornaments were cast from electrolytic matrices.

This is copy number

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